

PROPERTIES OF REPRESENTATIONAL ACTIVITY IN CALCULUS STUDENTS' CONSTRUCTION OF PROOF

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The goal of this study is to examine the construction and use of representations in mathematical problem solving, and, in particular, how representations arise and are deployed in their interactional, mathematical, and social contexts. Specifically, we examine students' representational activity while working on proof-based problems in undergraduate Calculus. This poster will demonstrate how reasoning with and through mathematical representations in this setting is interactionally accomplished and identify and characterize qualities of representations that shape those processes of reasoning and proving.

Data include audio-video recordings of a focus group in an introductory calculus course where discussion sections were organized as "workshops" in which students worked in small groups and instructors emphasized the need for explanation and justification. Recordings were content-logged and initial strips of interaction were selected for close interactional analysis. Using these, we developed grounded theoretical categories in an iterative fashion, integrating constructs from the literature, then extended our analysis systematically across the data corpus.

We draw upon two theoretical lenses to examine the students' construction and use of representations: first, we borrow from Speiser, Walter, & Sullivan (2007), who identify a representation as a presentation used to facilitate communication with oneself or others (p. 15); second, we view a representation as a cultural artifact with a local history of production as well as a history embedded in mathematical and pedagogical meanings and conventions (Latour, 1999).

Our analysis reveals three properties of representational activity—complementarity, prospectivity, and generativity—that we find important in understanding the constraints and affordances of representations in their interactional construction and use in mathematical explanation and justification. Complementarity refers to the coordination of multiple forms of representation to support reasoning beyond the affordances of a single representation. Prospectivity describes how representations, due to specific properties embedded in the structure and customary use of a certain representation, can afford prospective attention to and yet also bound the nature of immediate next steps in the problem-solving process. Generativity refers to the productive quality of representational activity for fostering new insights into mathematical situations, in particular across representational systems. This poster presentation will display selected examples of different representations—possessing one or more of these three properties—from the students' work, along with a discussion of the constraints and affordances of such representational activity for students' as they work together to produce proof and justification.

References

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